AIR RESOURCES LABORATORY

SEMINAR

How Do Instrument Changes Affect the Climate Record of Radiosonde Temperatures?

Dr. John Lanzante
NOAA Geophysical Fluid Dynamics Laboratory
Princeton, New Jersey

Temperature time series from radiosonde stations constitute a valuable resource for the study of low-frequency variations in the free atmosphere, both with regard to natural variations as well as those induced anthropogenically. Such series also serve as a major input to derived products such as the Reanalyses.

While studies from the last decade have suggested a potential impact on these climate series resulting from historical changes in instruments and measurement practices, quantification of the impact has proven elusive. The difficulties arise from the large variety of changes over time and from country to country, coupled with the often incomplete or erroneous documentation of instrument changes.

This work reports the first comprehensive quantitative evaluation based on a representative world-wide network of stations. After a brief explanation of the methodology used to identify and adjust inhomogeneities introduced via instrument-related changes, illustrative examples of some note-worthy problems are shown. Comparisons with an independent data set, derived from MSU satellite measurements for 1979-97, are used to place the radiosonde adjustment procedure in a favorable light and to highlight remaining discrepancies.

Results are reported of the impact of artificial inhomogeneities on low frequency variations in temperature from local to regional to global scales, with emphasis on trends for two time periods: 1959-97 and 1979-97. It is shown that the impact of data adjustment on trends can be quite large locally, is sometimes considerable regionally, and is present even globally. In some instances even the higher-frequency interannual variability may be affected. It is estimated that changes in the observing system have resulted in spurious cooling, leading to an overestimate of stratospheric cooling and an underestimate of tropospheric warming. Temporal changes in the lower tropospheric lapse rate, resulting from differential rates of warming at the surface vs. the free troposphere are found to be especially sensitive. Possible implications for use of the "fingerprint method" in detection of climate change are also presented. Finally, some avenues for future research are briefly discussed.

10:30A, October 19, 2001
SSMC3, Rm. 3404
1315 East-West Hwy., Silver Spring, MD

For more information contact Betty Wells, 301-713-0684, ext. 100